



Proof of the Accuracy of Calculation of Trigonometric Formulas for Spherical Triangles with Magnetic Declination Correction at *Istiwa A'zam* in Determining the Direction of the Qibla

Abdi Samra Caniago^{1*}, Gadis Arniyati Athar²

¹STAI Jam'iyah Mahmudiyah, Tanjung Pura Langkat, Indonesia

²Institut Syekh Abdul Halim Hasan Binjai, Indonesia

Corresponding Author  abdisamra80@gmail.com

ABSTRACT

This study departs from Arbisora's research which shows that there is a difference in the direction of the Qibla of the Al-Mashun Grand Mosque in Medan which is determined by the hisab method and the *rashdul Qibla* method. The researcher's temporary assumption is that this is because the hisab does not use magnetic declination. This study aims to prove the accuracy of the Qibla direction using the spherical triangle trigonometric hisab method with magnetic declination correction and the *istiwa a'zam* event. The research is field research, which was carried out at the Al-Mashun Grand Mosque in Medan City on July 15, 2024 which coincided with the *istiwa a'zam* event. The coordinate data of the Al-Mashun Grand Mosque in Medan was obtained from Garmin GPS 60, which is 98°41' 4.14" East Longitude and 3° 34' 30.79" North Latitude. For the coordinate data of the Kaaba, the latest data from Ahmad Izzuddin was used, as per the results of the study in 2007, namely 39° 49' 34.56" East Longitude and 21° 25' 21.17" North Latitude. The results of the study revealed that the calculation results of the spherical triangle trigonometry method with magnetic declination correction for the direction of the Qibla of the Al-Mashun Grand Mosque in Medan, namely the West to North Direction value = 23° 13' 52.2", the North to West Direction value = 66° 46' 7.8", and the azimuth value = 293° 13' 52.2". While the calculation results did not use magnetic declination correction, the azimuth value was 292° 46' 26.95". The results of field research on July 15, 2024 at 16:26 WIB during the *istiwa a'zam* event found that the Qibla Azimuth of the Al-Mashun Grand Mosque showed 293° the same as the *rashdul Qibla* from Arbisora 293° 20' 49.18". This proves that the hisab method using the magnetic declination correction method is more accurate.

Keywords: *Qibla Direction, Trigonometry, Istiwa A'zam, Correction of Magnetic Declination*

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INTRODUCTION

In Islam, prayer is a pillar of religion and an obligation for every Muslim. Prayer not only functions as a ritual but as a means to strengthen the relationship with Allah SWT as the creator. Discipline in performing prayers shows a Muslim's faith in Allah SWT. Facing towards the Qibla is one of the conditions for valid

prayer. The Qibla of Muslims faces the Grand Mosque in Mecca as stated in the Al-Quran Surah Al-Baqarah verse 144. In interpreting Surah Al-Baqarah verse 144, Abdul Halim Hasan explained Surah Al-Baqarah verse 144, namely the return of the direction of the people's Qibla from the Al-Aqsa Mosque in Jerusalem to the Grand Mosque in Mecca (Hasan, 2006). In fact, in a hadith it is stated that the Messenger of Allah, when traveling for obligatory prayers, prioritized facing the Qibla. Quoting the Sahih Bukhari hadith to explain the Qibla issue. From the Hadith of Jabir and others, it is clear that the Prophet once prayed facing East while riding in his vehicle, but when he intended to perform fardhu prayers, the Prophet got out of his vehicle and faced the Qibla. This shows that there is relief and it is permissible not to face the Qibla in certain circumstances, for example when traveling, it is dark so you cannot determine the direction of the Qibla. However, the Prophet did not leave facing the Qibla to perform the obligatory prayers (Alwi, 2020).

Mosques as places of prayer must provide the correct and accurate direction of the Qibla. So that the congregation does not make mistakes in the direction of the Qibla, so that the prayers performed are valid. However, in reality, many mosques in Medan City have the direction of the Qibla that is not yet appropriate. There are many directions of the Qibla of the Mosque that still need to be corrected, because many face the West (Dhiauddin Tanjung, 2018; Rahmadani & Putraga, 2020).

One of the mosques that matches the Qibla direction in the city of Medan is the Al-Mashun Grand Mosque (Dhiauddin Tanjung, 2018). As a landmark in the city of Medan, the Al-Mashun Grand Mosque was originally the royal mosque of the Deli Sultanate. The Qibla direction of this mosque was calculated by Mr. Sheikh Hasan Maksum an-Naqsyabandi (1884-1936), the mufti of the Deli Sultanate during the time of the Deli Sultan Sri Sultan Makmun Al Rasyid Perkasa Alamsyah who ruled from 1879-1924 AD. (Medan: Sjarikat Tapanoeli Medan). Sheikh Hasan Maksum an-Naqsyabandi uses two tools to determine the direction of the Qibla; compass and the sun. (Angkat, 2016)

This study is based on research conducted by Arbisora (Angkat, 2016) and Dhiauddin (Dhiauddin Tanjung, 2018) on the accuracy of the Qibla of the Al-Mashun Grand Mosque, Medan. According to these two researchers, the accuracy of the Qibla of the Al-Mashun Mosque is correct. In both studies, the azimuth values obtained in Dhiauddin's research ($292^{\circ} 45' 09''$) and Arbisora's ($292^{\circ} 46' 26.6''$), do not have a large difference, meaning that the level of accuracy of the azimuth value of the Al-Mashun Grand Mosque, Medan with the Hisab method between the two is almost accurate (only a difference of $0^{\circ} 1' 17.6''$ or 0.02155, obtained from $292^{\circ} 46' 26.6'' - 292^{\circ} 45' 09'' = 0^{\circ} 1' 17.6''$). Next, Arbisora checked the accuracy of the Qibla using the Rashdul Kiblat method, from the results the accuracy of the Al-Mashun Mosque Qibla deviated by $00 34' 22.58''$ or 0.5729388 (Angkat, 2016). There was a difference between the calculation results and the results of the Rashdul Kiblat method. The temporary assumption of the researcher is that the difference in Arbisora's research is because the hisab method does not use magnetic declination correction.

The Quran contains so much about the science of astronomy which is the basis for determining the direction of the Qibla (Hasibuan, Sabil, & Raisal, 2024). Determining the direction of the Qibla is related to astronomy, a branch of science that studies the movement of celestial bodies and determines important times for

worship. Astronomy is closely related to the application of science in trigonometry, Where trigonometry is one of the branches of mathematics (Azmi & Ukhti, 2023). Trigonometry discusses solving problems related to geometric shapes or spatial shapes related to measurement related to the size of angles without measuring directly (Susheri, 2012). By using the theory of spherical trigonometry, the direction of the Qibla can be determined. Spherical trigonometry is used to measure the angle of a plane on a spherical surface. The shape of the Earth is almost round like a ball, so by applying the spherical trigonometry formula, you can find the angle or direction between two different locations (Ahmad, Febryanti, & Tasni, 2019; Nurhanifah, Amriely, & Husaeni, 2023).

The earth has a spherical shape, so we can apply the principle of spherical trigonometry. Practically, we make a spherical surface by limiting it with three arcs that are part of a large circle. This concept makes it possible to find the position of celestial objects with a point on the earth's surface. It can also determine the direction and distance of a point on the surface.

Mathematics is also integrated with Islamic values.(Ahmad et al., 2019; Sari, Kartika, & Amirullah, 2024) Muslim scholar Al-Biruni was very instrumental in the development of trigonometry which is used to determine the direction of the Qibla. Al-Biruni explained in detail how to determine the azimuth of the Qibla by applying the spherical triangle formula (spherical trigonometry). In calculating the azimuth of the Qibla, it is assumed that the earth is a sphere so that there are three points: Point A is the point where the Kaaba is located, point B is the place where the direction of the Qibla will be determined and point C is the North Pole point. The three points can be described as being connected by a curved line (a, b, c are the sides) which then produces a spherical triangle. The angle enclosed by the line between the North Pole and the place which is the angle of the direction of the Qibla that will be calculated with the Kaaba is called the direction of the Qibla (Figure 1) (Nurhanifah et al., 2023).

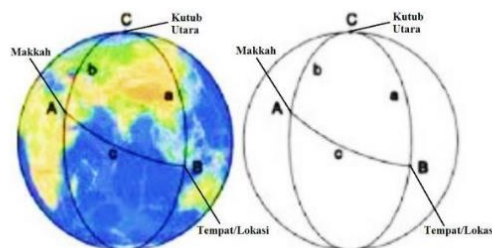


Figure 1. Determination of Three Points ABC

Astronomy is developing dynamically, currently the implementation of Qibla calculation is carried out by paying attention to the horizontal angle correction between Magnetic North and True North of the Earth (true north) to get more accurate and precise results. This correction is very important because there is a deviation from the angle formed by True North with the Magnetic North angle. In this process, it is important to pay attention to the azimuth position formed by the North point and the magnetic variation (correction from magnetic declination). Each place has a different variation in magnetic declination values (Siti Tatmainul Qulub, 2017; Zein, 2018). Currently, determining magnetic variations can be done using applications or websites available on smartphones. In his research, Arino (Sado, 2019) showed that the calculation of the direction of the Qibla carried out by considering the magnetic declination and geographic coordinates of the Earth

will affect the accuracy of the direction of the Qibla.

From the explanation above, the researcher wants to prove the accuracy of the spherical triangle trigonometric calculation method with magnetic declination correction and compare it with the results of the direction of the Qibla of the *Istiwa A'zam* event at the Al-Mashun Grand Mosque in Medan City.

METHOD

This research is field research. This study aims to determine the direction of the Qibla and prove the use of the spherical triangle trigonometry formula corrected by magnetic declination is more accurate in the hisab method.

This research was conducted at the Al-Mashun Grand Mosque in Medan City on July 15, 2024 at 16:26 WIB which coincided with the *Rashdul Qibla or Istiwa A'zam* event. This is a method of determining the direction of the Qibla which is guided by the position of the sun which is above the zenith point of the Kaaba. This situation occurs twice a year on May 27 and July 15 (*Kabisah*) or May 28 and July 16 (*Basithah*). Measuring and checking the Qibla direction can be done at 16.18 on May 27 and 28, while on July 15 and 16 at 16.26. In this method, the accuracy of the clock must be seen, so it requires clock accuracy with an official time application (Marpaung, 2015). The coordinate data for the mosque was obtained from GPS (Global Positioning System) 60 Garmin and it was obtained that the Al-Mashun Grand Mosque in Medan has coordinates ($98^{\circ} 41' 14.14''$) East Longitude and ($3^{\circ} 34' 30.79''$) North Latitude. For the coordinate data of the Kaaba, the latest data from Ahmad Izzuddin is used, as the result of research in 2007, namely ($39^{\circ} 49' 34.56''$) East Longitude and ($21^{\circ} 25' 21.17''$) North Latitude (Tim Penyusun Hisab Rukiyat, 2013). The calculation results will be compared with the observation results of *Rashdul Qibla Istiwa A'zam*.

The first step will be to calculate the direction of the Qibla based on the calculation results from the Spherical Triangle formula (spherical trigonometry) corrected by magnetic declination. This correction is as adopted by Siti Tatmainul Qulub's explanation (Siti Tatmainul Qulub, 2017). The spherical triangle formula is obtained from the lines that form the place and if the lines of the earth's surface are removed it will become a spherical triangle or spherical trigonometry (Figure 2) below:

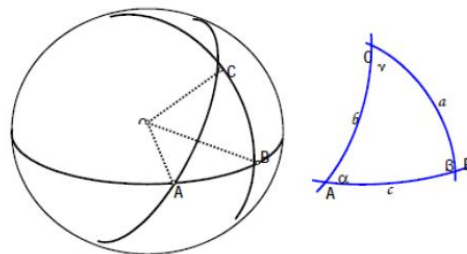


Figure 2. Illustration of the formation of spherical triangle ABC

From the image presented, we can get the following formula:

Rumus Cosinus:

$$\cos A = -\cos B \cos C + \sin B \sin C \cos a$$

$$\cos B = \cos A \cos C + \sin A \sin C \cos b$$

$$\cos C = \cos A \cos B + \sin B \sin A \cos c$$

For the sides of a spherical triangle:

$$\cos a = \cos b \cos c + \sin b \sin c \cos A$$

$$\cos b = \cos a \cos c + \sin a \sin c \cos B$$

$$\cos c = \cos b \cos a + \sin a \sin b \cos C$$

Sinus Pattern:

$$\frac{\sin A}{\sin a} = \frac{\sin B}{\sin b} = \frac{\sin C}{\sin c}$$

Next, the second step will be observing *Rashdul Qibla Istiwa A'zam* by observing the shadow of the sun with a stick at 16:26 WIB, the time has been accurate using the Time in Idaho application ("Time Idaho," 2024). Then the shadow is marked with a ruler and thickened with a colored marker. Then the direction of the Qibla is measured for accuracy with a SUUNTO compass.

RESULTS AND DISCUSSION

Result

First, the Qibla calculation is carried out using the spherical triangle calculation method that has been corrected with magnetic declination. This process begins with determining the coordinates of the Al-Mashun Grand Mosque in Medan using GPS. In the discussion in this study, the researcher presents calculations using various spherical triangle formulas to prove that all formulas used will produce the same results. Further results and calculations can be seen in the following explanation:

a. Qibla Direction Calculation Trigonometry Spherical Triangle

Determination of the required data, namely:

Kaaba Coordinates

$$\text{North Latitude} = 21^{\circ} 25' 21.17''$$

$$\text{East Longitude} = 39^{\circ} 49' 34.56''$$

Coordinates of the Al-Mashun Grand Mosque, Medan

$$\text{North Latitude} = 3^{\circ} 34' 30.79''$$

$$\text{East Longitude} = 98^{\circ} 41' 14.14''$$

Then the data is processed into elements that are used in the formula:

To find the value a

$$\begin{aligned} a &= 90^{\circ} - \text{North Latitude Mosque} \\ &= 90^{\circ} - 3^{\circ} 34' 30.79'' \\ &= 86^{\circ} 25' 29,21'' \end{aligned}$$

To find value b

$$\begin{aligned} b &= 90^{\circ} - \text{North Latitude Kaaba} \\ &= 90^{\circ} - 21^{\circ} 25' 21.17'' \\ &= 68^{\circ} 34' 38.83'' \end{aligned}$$

To find value C

$$\begin{aligned} \text{Value } C &= \text{longitude Mosque} - \text{longitude Kaaba} \\ &= 98^{\circ} 41' 14.14'' - 39^{\circ} 49' 34.56'' \\ &= 58^{\circ} 51' 39.58'' \end{aligned}$$

To get value c with the formula:

$$\begin{aligned} \cos c &= \cos a \cos b + \sin a \sin b \cos C \\ \cos c &= \cos (86^{\circ} 25' 29,21'') \cos (68^{\circ} 34' 38,83'') + \sin (86^{\circ} 25' 29,21'') \sin (68^{\circ} 34' 38,83'') \cos (58^{\circ} 51' 39.58'') \\ \cos c &= 0,5032289596588 \\ c &= \text{arc cos} (0,5032289596588) \\ c &= 59,786142824711 \end{aligned}$$

$$= 59^{\circ} 47' 10.11''$$

We got the values:

$$\text{Value } a = 86^{\circ} 25' 29.21''$$

$$\text{Value } b = 68^{\circ} 34' 38.83''$$

$$\text{Value } c = 59^{\circ} 47' 10.11''$$

$$\text{Value } C = 58^{\circ} 51' 39.58''$$

The next step is to use the spherical triangle formula to get the Qibla direction angle (B), the values that have been obtained will be entered into the spherical triangle formula that will be used. How to find it can be seen as follows:

Method 1: Finding the Qibla Direction with the Cosine Rule

By using the second cosine formula:

$$\cos b = \cos a \cos c + \sin a \sin c \cos B$$

From that formula we got:

$$\cos b - \cos a \cos c = \sin a \sin c \cos B$$

$$\cos B = \frac{\cos b - \cos a \cos c}{\sin a \sin c} \dots\dots\dots (\text{equation 1})$$

By using equation 1, the value of cos B is found:

$$\cos B = \frac{\cos(68^{\circ} 34' 38.83'') - \cos(86^{\circ} 25' 29.21'') \cos(59^{\circ} 47' 10.11'')}{\sin(86^{\circ} 25' 29.21'') \sin(59^{\circ} 47' 10.11'')}$$

$$\cos B = 0,3870996810362$$

It is found that:

$$B = \arccos 0,3870996810362$$

$$B = 67.22584717 = 67^{\circ} 13' 33.05''$$

Method 2: Finding the Qibla Direction with the Sine Rule

By using the sine rule formula:

$$\frac{\sin B}{\sin b} = \frac{\sin C}{\sin c}$$

From this formula we get that:

$$\sin B = \frac{\sin b \sin C}{\sin c} \dots\dots\dots (\text{equation 2})$$

$$\sin B = \frac{\sin(68^{\circ} 34' 38.83'') \sin(58^{\circ} 51' 39.58'')}{\sin(59^{\circ} 47' 10.11'')}$$

$$\sin B = 0,9220378839852$$

It is found that:

$$B = \arcsin 0,9220378839852$$

$$= 67,225847178102 = 67^{\circ} 13' 33.05''$$

Method 3: Finding the Qibla Direction with a Combination of Cosine and Sine

From the second cosine formula, namely:

$$\cos b = \cos a \cos c + \sin a \sin c \cos B$$

It is known that:

$$\cos c = \cos b \cos a + \sin a \sin b \cos C$$

From this formula it can be explained:

$$\cos b = \cos a (\cos b \cos a + \sin a \sin b \cos C) + \sin a \sin c \cos B$$

$$\cos b = \cos^2 a \cos b + \cos a \sin a \sin b \cos C + \sin a \sin c \cos B$$

$$\cos b = (1 - \sin^2 a) \cos b + \cos a \sin a \sin b \cos C + \sin a \sin c \cos B$$

$$\begin{aligned} \cos b &= \cos b - \sin^2 a \cos b + \cos a \sin a \sin b \cos C + \sin a \sin c \cos B \\ \sin a \sin c \cos B &= \cos b - \cos b + \sin^2 a \cos b - \cos a \sin a \sin b \cos C \\ \sin a \sin c \cos B &= \sin^2 a \cos b - \cos a \sin a \sin b \cos C \end{aligned}$$

The two sections are divided by $\sin a \sin b$, so :

$$\frac{\sin a \sin c \cos B}{\sin a \sin b} = \frac{\sin^2 a \cos b}{\sin a \sin b} - \frac{\cos a \sin a \sin b \cos C}{\sin a \sin b}$$

$$\sin c \operatorname{Cotan} B = \sin a \operatorname{cotan} B - \cos a \cos C$$

$$\operatorname{Cotan} B = \frac{\sin a \operatorname{cotan} B}{\sin c} - \frac{\cos a \cos C}{\sin c}$$

$$\operatorname{Cotan} B = \frac{\sin a \operatorname{cotan} B}{\sin c} - \cos a \operatorname{cotan} C$$

Then enter the values a, B, c and C into the formula:

$$\operatorname{Cotan} B = \frac{\sin(86^\circ 25' 29,21'') \operatorname{Cotan}(68^\circ 34' 38,83'')}{\sin(58^\circ 51' 39,58'') - \cos(86^\circ 25' 29,21'') \operatorname{cotan}(58^\circ 51' 39,58'')}$$

It is got:

$$\begin{aligned} \operatorname{Cotan} B &= 0.4198305612 \\ B &= \operatorname{arc} \operatorname{cotan} 0.4198305612 \\ &= 67.22584717 \\ &= 67^\circ 13' 33.05'' \end{aligned}$$

From methods 1, 2 and 3, the resulting angle for the direction of the Qibla is the same, namely $67^\circ 13' 33.05''$

b. Finding the direction of Qibla with Magnetic Declination Correction

Next, the point in the direction from West to North is searched for, namely:

$$\begin{aligned} &= 90^\circ - B \\ &= 90^\circ - 67^\circ 13' 33.05'' \\ &= 22.77415283 \\ &= 22^\circ 46' 26.95'' \end{aligned}$$

For the accuracy of the direction of the Qibla, the West to North direction point is corrected with magnetic declination to obtain the true north direction or *true north*. Note that if the magnetic declination result is below 1° then the result is added, if the result is at least 1° , the result is subtracted (Siti Tatmainul Qulub, 2017). With the help of the Geomag application (World Magnetic Model 2020 Calculator), the magnetic declination value was obtained, on July 15, 2024, of $0.457 = 00^\circ 27' 25.2''$. (Geomag, 2024)

So, the accuracy of the Qibla from West to North after being corrected with magnetic declination (DM) is:

$$\begin{aligned} B (DM) &= 00^\circ 27' 25.2'' + 22^\circ 46' 26.95'' \\ &= 23^\circ 13' 52.15'' \end{aligned}$$

Next, look for the direction North to West

$$\begin{aligned} &= 90^\circ - 23^\circ 13' 52.15'' \\ &= 66^\circ 46' 7.8'' \end{aligned}$$

Next, look for the azimuth value

$$\begin{aligned} &= 360^\circ - 66^\circ 46' 7.8'' \\ &= 293^\circ 13' 52.2'' \end{aligned}$$

Next, the Qibla Line Length is found (using a line length of 100 cm)

$$= \tan (\text{Qibla angle}) \times \text{line length}$$

$$= \tan 23^{\circ} 13' 52.2'' \times 100 \text{ cm}$$

$$= 42.924458339367 \text{ cm} = 42.92 \text{ cm}$$

From the calculation results above, we get:

West to North = $23^{\circ} 13' 52.2''$

North to West = $66^{\circ} 46' 7.8''$

Azimuth = $293^{\circ} 13' 52.2''$

Line length = 42.92 cm

Then it can be described as follows:

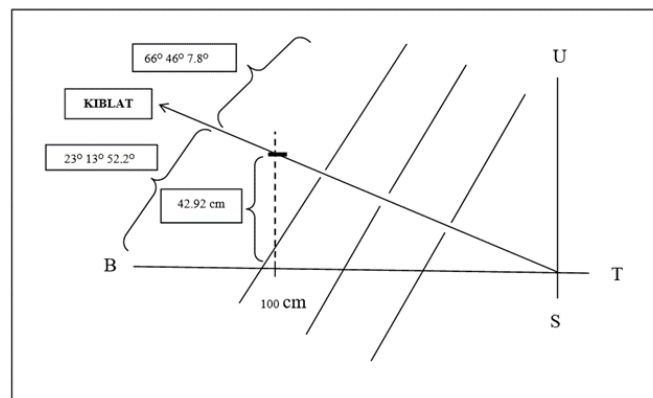


Figure 3. Image of the Calculation Results

c. Observation Results of *Rashdul Qibla Istiwa A'zam*

The results of direct observation in the field on July 15, 2024 at 16:26 WIB, the *Rashdul Qibla Istiwa A'zam* method with the following steps:

- a) Place the wood and make a line on the shadow of the direction of the Qibla that is formed. Then mark the shadow of the direction of the Qibla that is formed with a ruler and writing tools that have been adjusted to the time that has been corrected with www.time.is.id on a smartphone



Figure 4. Observation Activity of *Rashdul Qibla Istiwa A'zam* July 15, 2024 Al-Mashun Grand Mosque Medan, North Sumatra

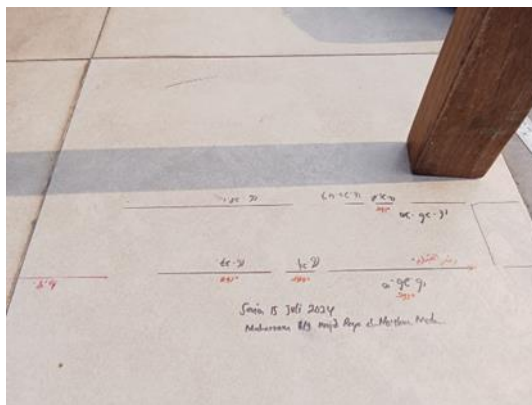


Figure 5. Results of *Rashdul Qibla Istiwa A'zam* Observations July 15, 2024 Al-Mashun Grand Mosque, Medan, North Sumatra

- b) From the shadow of the direction of the Qibla that is formed, then the value is seen with the SUUNTO Compass, starting from the time before *Istiwa A'zam* until after. Furthermore, the results of the direction of the Qibla of the Mosque, the results of the calculation and the shadow of the direction of the Qibla when *Istiwa A'zam* are compared. Where the results of the SUUNTO Compass show the Azimuth of the direction of the Qibla 293° according to the calculation using the magnetic declination correction value. From the results of the observation, the direction of the Qibla of the Al-Mashun Grand Mosque is 292° .

The results of the Qibla azimuth values from the *Rashdul Qibla Istiwa A'zam* calculation and observation activities can be seen in table 1 below:

Table 1. Azimuth Values

No Magnetic Declination	Using Magnetic Declination	Observation
$292^{\circ} 46' 26,95''$	$293^{\circ} 13' 52,2''$	293°

From the table above, it can be seen that the calculation results using magnetic declination are closer in accuracy to the results of *Rashdul Qibla Istiwa A'zam's* observations.

Discussion

From the observation of *Rashdul Kiblat Istiwa A'zam*, it was found that there was a difference with the direction of the Qibla by 0.2 from the direction of the Kaaba. The calculation *hisab* results using magnetic declination correction (calculation results of $293^{\circ} 13' 52.2''$) were closer in accuracy to the results of *Rashdul Kiblat Istiwa A'zam's* observations (of 293°). With a difference of $0^{\circ} 13' 52.2''$ or 0.23116. The results of this study are closer to the results of *Rashdul Qibla* from Arbisora's research (Angkat, 2016).

In Arbisora's research using the *Rashdul Qibla* method, the deviation of the direction of the Qibla of the Al-Mashun Grand Mosque in Medan is $0^{\circ} 34' 22.58''$ or 0.50627, while the Azimuth of the Al-Mashun Grand Mosque in Medan is $292^{\circ} 46' 26.6''$ (Angkat, 2016). Thus, the Azimuth of the Al-Mashun Grand Mosque in Medan based on the *Rashdul Kiblat* observation conducted by Arbisora is $293^{\circ} 20' 49.18''$. If the results of *Rashdul Qibla* Arbisora are compared with the results of Dhiauddin's calculations, the deviation is $0^{\circ} 35' 40.18''$ or 0.594494 (obtained from

subtracting $293^{\circ} 20' 49.18''$ with $292^{\circ} 45' 09''$). Then, if we compare the azimuth value from the research results of *Rashdul Qibla* Arbisora with the calculation results carried out by researchers using magnetic declination correction, it is close to accuracy with a difference of $0^{\circ} 6' 56.98''$ or 0.11582 (obtained from subtracting $293^{\circ} 20' 49.18''$ with $293^{\circ} 13' 52.2''$).

Among the striking differences with Arbisora's research are the coordinate data of the Al-Mashun Grand Mosque and the Kaaba, the time of *Rashdul Qibla* (not during *Istiwa A'zam*) and not using magnetic declination correction. Meanwhile, Dhiauddin's coordinate data for the Mosque and Kaaba are different and the last two, out of the three, are not used. However, when comparing the results of *Istiwa A'zam* with the Azimuth calculation of the direction of the Arbisora Qibla, a difference of $0^{\circ} 13' 33.4''$ or 0.22594 (obtained from subtracting 293° with $292^{\circ} 46' 26.6''$). Meanwhile, Dhiauddin obtained a difference of $0^{\circ} 14' 51''$ or 0.2475 (obtained from subtracting 293° with $292^{\circ} 45' 09''$ $0^{\circ} 14' 51''$).

It should be added that the results on the SUUNTO compass from direct observation are not exactly at 293° , little more than 293° . This means more than 293° . Thus, the accuracy of the calculation is closer to the magnetic declination. For example, if the Azimuth of *Istiwa A'zam* is $293^{\circ} 01' 00''$, then the calculation with magnetic correction produces a result of $0^{\circ} 12' 52.2''$ or 0.2145 (obtained from subtracting $293^{\circ} 13' 52.2''$ with $293^{\circ} 01' 00''$). The calculation of the Arbisora Azimuth produces a result of $0^{\circ} 14' 33.4''$ or 0.24261 (obtained from subtracting $293^{\circ} 01' 00''$ with $292^{\circ} 46' 26.6''$). the result of Dhiauddin's Azimuth is $0^{\circ} 15' 51''$ or 0.26416 (obtained from subtracting $293^{\circ} 01' 00'' - 292^{\circ} 45' 09''$). If the Azimuth of *Istiwa A'zam* is added again, for example $293^{\circ} 03' 00''$, then the result with magnetic declination correction will be smaller, the difference is 0.18116 or $0^{\circ} 10' 52.2''$, while the calculation without using correction will be bigger. Arbisora is in second place with a difference of 0.27594 or $0^{\circ} 16' 33.4''$ or, then Dhiauddin is in third place with a difference of 0.2975 or $0^{\circ} 17' 51''$.

So it can be concluded that the calculation of the direction of the Qibla with the latest coordinate data, time correction and magnetic declination correction (true north) is more accurate than not using it. This can be a subject for further discussion in research in the field of Falak science, especially for research on the direction of the Qibla.

CONCLUSION

The results of the study revealed that the proof of the calculation results using the latest coordinate data, time correction and corrected with magnetic declination (true north) is closer to (0.2) with the results of *Rashdul Qibla Istiwa Azam* on July 15, 2024 at 16:26 WIB. The results of the calculation of the direction of the Qibla using the spherical triangle formula of the Al-Mashun Grand Mosque, as intended, from West to North = $23^{\circ} 13' 52.2''$, the value of the North to West direction = $66^{\circ} 46' 7.8''$, the azimuth value = $293^{\circ} 13' 52.2''$. The results of the shadow of the direction of the qibla of *Rashdul Kibalt Istiwa A'zam* seen on the SUUNTO compass are 293° , and the results of the direction of the Qibla of the Al-Mashun Grand Mosque are 292° . This result when compared with the observation result with SUUNTO compass on *Istiwa Azam* event with calculation with magnetic declination correction obtained difference of $0^{\circ} 13' 52.2''$ or 0.23116 (obtained from subtracting $293^{\circ} 13' 52.2''$ with 293°). When compared with *Rashdul Qibla* Arbisora result with calculation with magnetic declination correction, the difference is 0°

$06^{\circ} 56.98^{\circ}$ or 0.11582 (obtained from subtracting $293^{\circ} 20' 49.18''$ with $293^{\circ} 13' 52.2''$). Likewise, when compared with *Rashdul Qibla Istiwa A'zam* result with Azimut Arbisora and Dhiauddin calculation result.

Suggestions for subsequent researchers can apply the same thing by utilizing the momentum of *Istiwa A'zam* for further refinement. Especially for areas where the magnetic declination is at least above 1° , because this study the magnetic declination is below 1° . Of course, in mosques that have been studied or whose accuracy of the direction of the Qibla has been calculated.

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